# Homework 7

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## Contents

# 1 Page 304: problem 2

The bridges and land masses of a certain city can be modeled with graph G in figure 8.7.

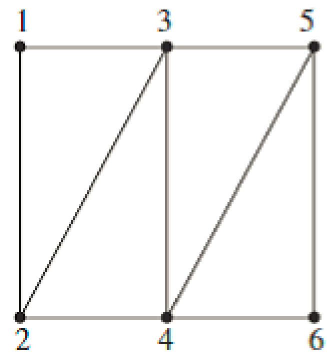



Figure 1:

## 1.1 a. is G Eularian? Why or why not?

No, because there are vertices of odd degrees (2 and 5).

## 1.2 b. Suppose we relax the requirement of the walk so that the walker need not start and end at the same land mass but still must traverse every bridge exactly once. Is this type of walk possible in a city modeled by the graph in figure 8.7? If so, how? If not, why not?

Yes, it is possible to travese each edge once.
We can start our walk at 2 and then traverse as follows:

1. 2 to 1
2. 1 to 3
3. 3 to 2
4. 2 to 4
5. 4 to 5
6. 5 to 3
7. 3 to 4
8. 4 to 6
9. 6 to 5

# 2 Page 307: problem 1

Consider the graph in Figure 8.11.

## 2.1 a. Write down the set of edges E(G)

$E(G) = \{ab, ae, af, bc, bd, cd, de, df, ef\}$

## 2.2 b. Which edges are incident with vertex b?

ab, bc, and bd

## 2.3 c. Which vertices are adjacent to vertex c?

b and d

## 2.4 d. Compute deg(a)

deg(a) = {ab, ae, af} = 3

## 2.5 e. Compute $|E(G)|$

$|E(G)| = \{ab, ae, af, bc, bd, cd, de, df, ef\} = 9$

## 3 Page 320: problem 10

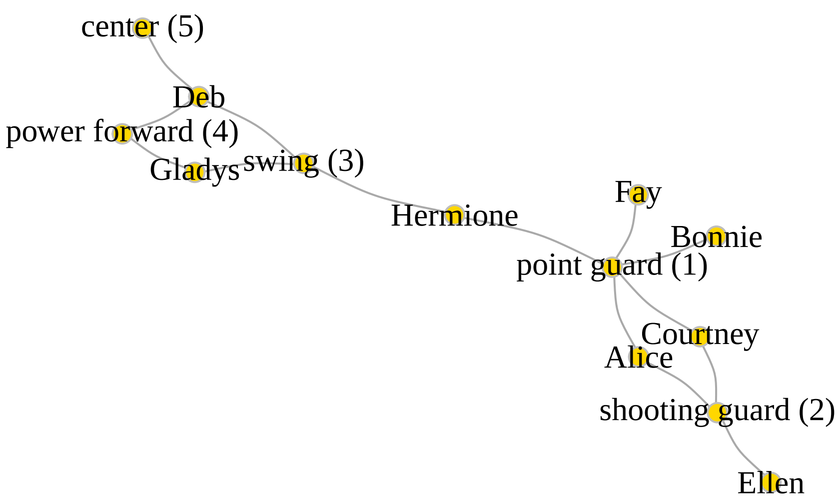
A basketball coach needs to find a starting lineup for her team. There are five positions that must be filled: point guard (1), shooting guard (2), swing(3), power forward (4), and center (5). Given the Table 8.7, create a graph model and use it to find a feasible starting lineup. What changes if the coach decides she cant play Hermione in position 3?

```
library(igraph)
```

```
b_team <- data.frame(from = c('Alice','Alice',
                                  'Bonnie',
                                  'Courtney', 'Courtney',
                                  'Deb',  'Deb',  'Deb',
                                  'Ellen',
                                  'Fay',
                                  'Gladys', 'Gladys',
                                  'Hermione', 'Hermione'),

                        to = c('point guard (1)','shooting guard (2)',
                               'point guard (1)',
                               'point guard (1)','shooting guard (2)',
                               'swing (3)', 'power forward (4)', 'center (5)',
                               'shooting guard (2)',
                               'point guard (1)',
                               'swing (3)', 'power forward (4)',
                               'point guard (1)', 'swing (3)'),
                        weight = c(1,1,1,1,1,1,1,1,1,1,1,1,1,1 ))

df_b_team <- graph.data.frame(b_team, directed=FALSE)
plot(df_b_team,vertex.color="gold",
     vertex.size=6,
     asp = .7,
     vertex.frame.color="gray",
     vertex.label.color="black",
     edge.curved=0.2)
```




Using the graph, we can see that a possible lineup is:
Ellen - Shooting Guard
Fay - Point Guard
Hermione - Swing
Gladys - Power Forward
Deb - Center

If the coach decides she can't play Hermione in position 3 swing, she wont be able to fill the lineup. This is because Deb and Gladys are the only others that can play position 3 but they also are the only ones that can play other positions.

## 4 Page 331: problem 1

Find a shortest path from node $a$ to node $j4$ in the graph in Figure 8.33 with edge weights shown on the graph.

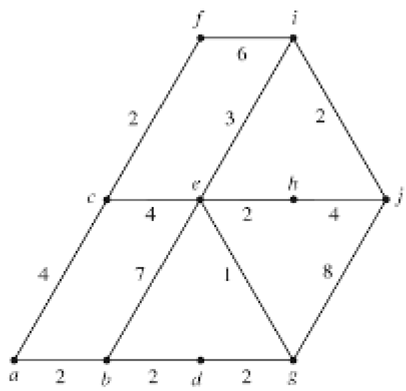



Figure 2:

```
path <- data.frame(from=c('a','a','b','b','c','c',
                          'd','e','g','f','i','e',
                          'h', 'e'),
                   to =c('b','c','e','d','e','f',
                         'g','g','i','i','j','h',
                         'j','i'),
                        weight = c(2,4,7,2,4,2,
                                   2,1,8,6,2,2,
                                   4,3))

g <- graph.data.frame(path, directed=FALSE)

path_length <- shortest.paths(g, v = 'a', to = 'j')

path_output <- get.shortest.paths(g, 'a', 'j')

path_output$vpath[[1]]
```

```
## + 7/10 vertices, named:
## [1] a b d g e i j
```

The shortest path is 12 and the path is (a b d g e i j).